Sandia National Laboratories
Primary Hazard Screening (PHS)

PHS Number: SNL07A00126-004

CINT Rm: 1527/1528 - Etch Lab

I. Signatures (Electronic signature dates shown)

Risk Management Determination

Hazard Classification: **Low**

Required Documentation: **PHS with integral HA**

Facility/Project Designator: **Non-nuclear Facility**

Date Created: **01/16/2010**

DOE Order References: **425.1C**

Results as of: **02/24/2010**

Activity-level PHS: **N**

Author / Technical Review:

I am knowledgeable of the activities and hazards covered by this PHS and, after doing due diligence, the description, notes, identified hazards, analyses, and other information contained in this PHS are complete and accurate.

Author : **Nogan,John** Org: **01132** **02/23/2010 19:08:44**

The description and notes describe and scope the activities performed under this PHS. All hazards have been identified. Questions are answered correctly and, as necessary, rationale or clarification is provided. All hazards in the HA have been analyzed, including the identification of controls for each hazard. I have performed the above reviews and concur that those items are complete and accurate.

ES&H Coordinator : **Starr,Michael** Org: **01131** CONCUR - **02/24/2010**

Quality Review:

This PHS meets minimum Corporate standards for 1) description/notes and 2) required information. There are no gross inconsistencies. I have performed the above reviews and concur that those items are complete and accurate.

PHS Team : **Costanzo,Jessica Amoret** Org: **04126** CONCUR - **02/24/2010**

Approver:

The description and notes describe and scope the activities performed under this PHS. All hazards have been identified. Questions are answered correctly and, as necessary, rationale or clarification is provided. All hazards in the HA have been analyzed, including the identification of controls for each hazard. I have reviewed this PHS and concur that its contents are accurate and complete. I will ensure that the requirements and commitments in this PHS are implemented prior to the start of work.

Approving Manager : **Hearne,Sean J.** Org: **01132** APPROVE - **02/24/2010**

II. PHS Purpose, Limitations, and Use in Work Planning and Control

Purpose of the PHS

For the scope of work identified, the PHS identifies:

- High-level (primary) hazards (e.g. chemicals, toxic gasses, explosives)
- Some, but not all controls (e.g. PPE, respirators, ventilation, lockout/tagout, and NEPA), please see the limitations section, below for additional information.
- A Hazard Classification, which determines the requirements for additional Safety Basis documents [e.g., Hazard Analysis (HA), Safety Assessment (SA), Safety Assessment Document (SAD), Documented Safety Analysis (DSA) etc.]
- For the hazards and controls identified, the PHS enables the identification and communication of:
  - Requirements documents (such as ES&H Manual chapters, sections, and supplements) that must be reviewed to determine specific requirements applicable to the work
  - ES&H Manual-required training
  - Action and Warning messages that highlight key requirements.

The Hazard Analysis section of the PHS is used to perform a high-level hazards analysis and controls selection for hazards with a Hazard Classification of 'Low' and, optionally, for Standard Industrial Hazards (SIH).

Limitations of the PHS for Use in Activity-level Work Planning and Control

Unless additional information is specifically added, a PHS **does not** contain all of the detail necessary to identify and control hazards at the activity/task level. The reasons for this include:

- PHSs are typically written at the project or work-area level and therefore, do not contain sufficient detail about individual tasks or the hazards/controls associated with them.
- While the PHS provides requirements for the hazards and controls identified, it **does not** provide a comprehensive list of all requirements in the ES&H Manual and related documents. Furthermore, many of the requirements are identified by reference to sections of the ES&H Manual, which must be evaluated for requirements applicable to the specific work being performed.
- It is impractical to ask enough questions to generate the level of detail necessary for activity/task-level hazard identification and control; human analysis must be employed. Consequently, details must be developed by a work planner, including:
  - Specific details about the hazard (e.g. what chemical, which laser, when, under what conditions, and where)
  - Other controls needed, since the only controls automatically identified are the ones with ES&H Manual requirements that result from their use. Important controls, such as access control, interlocks, shielding, monitoring, and personnel qualifications are not identified.
  - Specificity about controls (e.g. type of PPE, ventilation specifications)
  - Details on how and when you implement each control
  - Information on who needs to take what training

Recommended Use of the PHS to Support Activity-Level Work Planning & Control

The information developed in the PHS and any resultant Safety Basis documents should be utilized when performing the subsequent task of activity-level hazard identification, analysis, and control selection, where (1) the major work steps are identified; (2) the hazards associated with each major step are identified and analyzed; and (3) the controls for each hazard are identified and verified to be adequate to protect the involved workers. For the vast majority of work performed at Sandia, the Job Safety Analysis form (SF 2001-JSA) or equivalent is the recommended tool to use for this purpose. The JSA provides a systematic process for a team of involved workers and SMEs to ensure the activity-level work scope is rigorously analyzed to identify all potential hazards and specify appropriate controls for each hazard. Information from the PHS and Safety Basis documents is used as an input in developing the JSA, and the results of the JSA are used to develop TWDs, procedures, or other work instructions as appropriate.

In some cases, the PHS system may be used for activity level hazard identification, analysis, and controls identification, however, the PHS usually must be supplemented with additional information to provide the level of detail necessary to serve this purpose. In these cases, a PHS should be designated as an "Activity-Level PHS" on the PHS General Information page; however, these PHSs will be reviewed during the review and approval process to confirm that they contain the detail necessary to identify the hazards and controls at any stage of the work being performed. If determined to not be adequate, options include (1) revising the PHS to include adequate information; or (2) removing the "Activity-Level PHS" designation, and using a JSA/JSA-equivalent process to perform activity-level hazard identification, analysis, and control selection.

III. Table of Contents

IV. General Information

Document Status

Question Set Version: **I**

Status: **APPROVED** Expiration Date: **02/24/2011**

Responsible Organization: **01132**

Radiological Protection Level for this facility or project: **None**

Description

Bay 1527 has two inductively coupled plasma (ICP) etch systems, a plasma enhanced chemical vapor deposition (PECVD) system, an electron beam/thermal evaporator, and a small bench top sputtering tool. The PECVD system allows the conformal deposition of multiple types of dielectric and other materials, such as poly-Si, silicon nitride, and silicon oxides. The ICP etch systems are used for etching for dry etching aluminum, carbon, oxides, nitrides, polysilicon, among other materials. Each of the etch tools have class 2 lasers for endpoint detection. Non-toxic gasses are stored in chase #1530 and are distributed into chase 1528, whereas the toxic gasses are self-contained within built-in toxic gas cabinets in each tool. A fully automatic silane gas cabinet for the CVD reactor is also located in chase 1528. There are toxic gas monitoring sensors located in each of the gas cabinets and in the vicinity of the tools to detect leaks. An ellipsometer with class 3a laser provides a means for thin film thickness and refractive index measurement. Additionally, a scanning laser 3a tool, called a Flexus, is located in 1527 and used to measure wafer curvature. The system is interlocked for safety purposes.

The Toxic Gas Monitoring System (TGMS) system is comprised of a decentralized Life Safety Network based on the LonWorks Technology with intelligent network nodes. The digitally networked input/output devices will notify personnel and shut down equipment based on a program customized for the requirements of the CINT Integration Labs.

Network devices include Honeywell (MST Technology) Satellite FTT gas monitors, Echelon digital interface modules, bus monitors, a Local Information Display and DVS (Data Visualization System). Output devices include beacons/horns, relay shut down of gases and signals to the Sandia Fire Protection panel for notification to the Sandia Emergency Operation Center.

Notes from Document or Interview

General Document Notes

Locations

Primary Location

Site : **SSTP** Area : **No Tech Area** Bldg : **518** Room : **N/A**
Detail : **Lab 1527**

Other Locations

None Entered

Responsible Organization History		
Organization Number	**Effective (Starting) Date**	**This Org. Submitted Document for Review**
01132	06/11/2004	Y

V. Identified Hazards

Hazard Name	Hazard Description	Source (Question or Table)
traffic related hazards	traffic related hazards for injury	Required by general corporate business process
common electrical hazards	common electrical hazards	Required by general corporate business process
Use or storage of chemicals	Potential personnel exposure to chemicals & fire protection regulatory requirements	QUESTION 5
Standard industrial levels of chemicals	Corrosive chemical; Potential exposure to skin and eyes.	QUESTION 5e
Noncompliant storage, dispensing, or use of flammable/combustible liquids could cause fire/explosion.	fire/explosion hazard	QUESTION 5h
Chemical physical hazards	hazards from fires, reactions, and explosions	QUESTION 5i
Use or storage of flammable gasses	Potential fire and explosion	QUESTION 5i(1)a
Toxic gasses	Potential exposure to toxic gasses in the event of a release	QUESTION 5k(1)
Exposed and energized electrical circuits	potential electrical shock or arc	QUESTION 6a
Circuit Breakers or disconnect switches at 50 V or more	potential electrical arc from operating circuit breakers or disconnect switches	QUESTION 6b
Electrical equipment operating at 50V or greater that is not NRTL-approved	unknown hazard potential since items have not gone through the standards, testing rigor, and hazard analysis associated with an NRTL-evaluation	QUESTION 6d(1)
Unevaluated nonionizing radiation	Potential exposure to nonionizing radiation.	QUESTION 8a
Standard industrial pressure hazard(s)	Injury or damage	QUESTION 10
Environmental concern below LOW hazard classification requirements.	potential for regulatory action	QUESTION 15
Air discharge, SIH hazard	potential to emit regulated contaminants	QUESTION 15b
Regulated chemicals	potential to emit regulated contaminants	QUESTION 15b(3)

VI. Required Actions

Off-Site Requirements:

NONE
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Warning Messages:

1. There are a variety of requirements applicable to chemicals. Refer to the portions of MN471001 ES&H Manual relevant to the activities being performed for requirements. **Comment added: Requirements in Corporate Procedures ESH100.2.IH.1 Maintain a Workplace Free from Chemical, Physical, Biological, and Safety Workplace Hazards, ESH100.2.IH.4 Evaluate and Control Chemical Hazards have been implemented are adhered to by personnel.** (QUESTION 5)
2. Flammable and combustible liquids must be bonded in accordance with the requirements in: The Sandia, "Log of Consultation." **Comment added: The requirements in the "Log of Consultation" will be implemented as needed.** (QUESTION 5g)
3. Any activity inside the Limited Approach Boundary is considered working near energized parts and requires a senior-manager-approved technical work document (TWD). (QUESTION 6a)
4. 10 Code of Federal Regulations Part 851, Worker Safety and Health Program, as implemented through various Sandia requirement documents (e.g., MN471001 ES&H Manual, PG470246, 10 CFR 851, Worker Safety and Health Program Plan), requires an exposure assessment of workplace hazards to ensure hazards have been identified and prevented or abated. **Comment added: Industrial Hygiene will be contacted to evaluate the magnetic fields of the PECVD systems.** (QUESTION 8a)
5. All operators of the system must be qualified according to the requirements of the Pressure Safety Manual. The Pressure Operator Qualification Form (SF 2001-PQF) is available as an optional tool for documenting the applicable training and qualification requirements for pressure applications. See MN471000, Pressure Safety Manual, Chapter 2, "The Pressure Safety Program," for requirements and guidance on qualification of pressure operators. **Comment added: Personnel have completed the necessary training for operating pressure systems.** (QUESTION 10a)
6. All installers of the system must be qualified according to the requirements of the Pressure Safety Manual. The Pressure Operator Qualification Form (SF 2001-PIQ) is available as an optional tool for documenting the applicable training and qualification requirements for pressure applications. See MN471000, Pressure Safety Manual, Chapter 2, "The Pressure Safety Program," for requirements and guidance on qualification of pressure installers. **Comment added: Pressure installers have completed the necessary training for operations.** (QUESTION 10b)

Action Messages:

1. Where eyes or body of any person may be exposed to injurious corrosive materials, suitable facilities for emergency quick drenching or flushing of the eyes and body shall be provided within the work area for immediate emergency use. See MN471001, ES&H Manual, Section 6M, "Safety Showers and Eyewashes," for requirements and guidance. **Comment added: An emergency eyewash/shower is available and is tested on a regular basis.** (QUESTION 5e)
2. Contact Site Fire Marshal for an Operational Permit. See the ES&H Direct Access Services List. **Comment added: A Line, Facilities, and ES&H team is identifying corrective actions to address site-wide issues with maximum allowable quantities for hazardous materials. Therefore, Operational Permits are not being issued at this time. Once corrective actions are identified, Operational Permits will be addressed by the Facility Fire Protection Assessment process (AP-230).** (QUESTION 5g)
3. Refer to "Log of Consultation," with a subject of, "Storage, Dispensing, Bonding, and Grounding of Flammable and Combustible Liquids." Contact Fire Protection Engineering for assistance. See the ES&H Direct Access Services List. **Comment added: The requirements in the "Log of Consultation" will be implemented as needed.** (QUESTION 5h)
4. Work on energized electrical circuits is restricted to certain individuals. Ensure only qualified personnel perform work on electrical equipment/systems at SNL. It is the responsibility of the department manager to

determine an employee's electrical qualifications. To become qualified to perform electrical work a person shall do the following:
Demonstrate a familiarity, through interview, demonstrated experience (i.e., resume/review) or direct observation, with the hazards of the workplace and the specific equipment to be worked on, as well as any associated ES&H Standard Operating Procedures (SOPs) and Operating Procedures (OPs).
Demonstrate a familiarity, through interview, demonstrated experience (i.e., resume/reference) or direct observation, with electrical maintenance techniques, codes, and other general electrical knowledge.
Have qualifications reviewed and approved by their department manager to ensure they are qualified for a particular job assignment.
NOTE: A person qualified to work with certain equipment may be considered "unqualified" to work on similar equipment without first being advised of any differing hazards involved. (QUESTION 6a)
5. Use a technical work document (TWD) to perform energized work as follows: If the energized work is diagnostic (such as troubleshooting, measuring voltage, etc.), an OP is required. You can find an example of a completed energized electrical OP on the Electrical Safety homepage. This could easily be used as a template for any R&D electrical activity. If the work involves manipulation or reconfiguration of an energized component, an Energized Work Permit (EWP) must be completed. A EWP is needed each time such tasks are to be completed. An EWP may be obtained from the SNL internal web under Corporate Forms EWP-SF2005-EWP (10-2005). (QUESTION 6a)
6. The energized work decision tool shall be used to determine PPE and hazard analysis requirements. Prior to PPE use, workers shall receive site-specific PPE training. See MN471001, ES&H Manual, Section 4L, "Personal Protective Equipment (PPE)" for requirements and guidance regarding site-specific PPE training. See MN471004, Electrical Safety Manual, Chapter 2 "General Requirements," "2.10 Personal Protective Equipment," for requirements and guidance. (QUESTION 6a)
7. Identify PPE, shock approach, and arc flash boundary prior to operating disconnect switches. In addition, personnel must be trained on safe switching techniques/hazards. See MN471004, Electrical Safety Manual, Chapter 2, "General Safety Requirements," sections: "2.1 Electrical Work Requirements - General," "2.2 Qualifications and Training," and "2.10 Electrical Personal Protective Equipment" for requirements and guidance. (QUESTION 6b)
8. All electrical equipment that is not NRTL-listed must be evaluated by an authorized equipment inspector. Contact your ES&H Coordinator for additional information on equipment inspections or to identify an authorized equipment inspector. (QUESTION 6d(1))
9. Contact the Industrial Hygienist on the appropriate Division ES&H Team prior to using nonionizing radiation sources, to evaluate exposure to nonionizing radiation and determine control measures. **Comment added: Industrial Hygiene will be contacted to evaluate the magnetic fields of the PECVD systems.** (QUESTION 8a)
10. In California, Contact the Air SME if any of the chemicals being used are listed on the Toxic Air Contaminants Table. **Comment added: No action needed. Operations are in SNL/NM.** (QUESTION 15b(3))
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Required Training

[Note: This training is a regulatory requirement for one or more people involved in operations associated with identified hazards. Each class may not be required by all people working in the area.] Please note that some training classes are only provided occasionally. Please be sure to allow adequate lead-time for personnel to schedule and complete training.]

Course Code	Course Title	Exclusions	Training Interval (Years)	One-time Training
CHM103	SITE-SPECIFIC CHEMICAL SAFETY TRAINING		2	No

Course Code	Course Title	Exclusions	Training Interval (Years)	One-time Training
ELC106	R&D ELECTRICAL SAFETY (> 50 VOLTS)	ELC106, unless not required by the energized work decision tool	--	Yes
ELC106R	R&D ELECTRICAL SAFETY REFRESHER (> 50 VOLTS)	unless not required by the energized work design tool.	3	No
ELC901	SAFE SWITCHING BRIEFING		--	Yes
ESH100	ES&H AWARENESS		1	No
ESH200	SAFETY MANAGEMENT		--	Yes
HAZ101	EMPLOYEE BASIC HAZCOM	LAB100 is acceptable for emergency response activities, if already completed	2	No
HAZ103	SITE-SPECIFIC HAZCOM		2	No
LAB100	LABORATORY STANDARD INFORMATION AND TRAINING	LAB100 (HAZ101 is acceptable if already taken)	2	No
LAB103	SITE-SPECIFIC LABORATORY SAFETY TRAINING		2	No
PPE106	PERSONAL PROTECTIVE EQUIPMENT TRAINING		2	No

Course Code	Course Title	Exclusions	Training Interval (Years)	One-time Training
PRS150	PRESSURE SAFETY ORIENTATION	for all operators of the system for all installers of the system	--	Yes
PRS150R	PRESSURE SAFETY ORIENTATION REFRESHER		3	No
PRS250	ADVANCED PRESSURE SAFETY	for all installers of the system	--	Yes
PRS250R	ADVANCED PRESSURE SAFETY REFRESHER		3	No

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Regulatory Requirements

Regulatory and Standards Drivers for this Facility or Lab:
[Note: ES and H Manual sections listed below contain requirements and guidance that pertain to the hazards you have identified in this PHS. It is your responsibility to ensure these requirements have been fulfilled.]

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1. (QUESTION 5) MN471001, ES&H Manual, Section 6D, "Hazard Communication Standard," and Section 6E, "Laboratory Standard - Chemical Hygiene Plan"
2. (QUESTION 5) MN471001 - ES&H Manual, Section 6E, Laboratory Standard - Chemical Hygiene Plan
3. (QUESTION 5) MN471001, ES&H Manual, Section 6U, "Hazardous Material (Chemical and Biological) Inventory"
4. (QUESTION 5e) MN471001 - ES&H Manual, Section 6M, "Safety Showers and Eyewashes"
5. (QUESTION 5h) MN471001, ES&H Manual, Section 5A, "Fire Protection Requirements"
6. (QUESTION 6a) MN471001 - ES&H Manual, Section 4L, "Personal Protective Equipment (PPE)" for requirements and guidance regarding site-specific PPE training
7. (QUESTION 6a) MN471004 - Electrical Safety Manual, Chapter 2 "General Safety Requirements," 2.10 "Electrical Personal Protective Equipment," for requirements and guidance
8. (QUESTION 6a(2)) MN471004 - Electrical Safety Manual, Chapter 2 "General Safety Requirements," "2.2 Qualifications and Training"
9. (QUESTION 6d(1)) MN471004 - Electrical Safety Manual, Chapter 4, "Research and Development-Specific Requirements," "4.3 Safe Work Practices"
10. (QUESTION 8) MN471001 - ES&H Manual, Section 6J, "NonIonizing Radiation"
11. (QUESTION 8a) MN471001 - ES&H Manual, Section 6J, "NonIonizing Radiation"
12. (QUESTION 10a) MN471000 - Pressure Safety Manual, Chapter 2, "The Pressure Safety Program"
13. (QUESTION 10b) MN471000 - Pressure Safety Manual, Chapter 2, "The Pressure Safety Program"
14. (QUESTION 10d) MN471000 - Pressure Safety Manual, Chapter 9, "Documenting the Operational Safety of Pressure Systems"

15. (QUESTION 10e) MN471000 - Pressure Safety Manual, Chapter 9, "Documenting the Operational Safety of Pressure Systems"
16. (QUESTION 10f) MN471000 - Pressure Safety Manual, Chapter 6, "Testing and Evaluating Pressure Systems"
17. (QUESTION 10f) MN471000 - Pressure Safety Manual, Chapter 7, "Verifying the Safe Operation of Pressure Systems"
18. (QUESTION 10f) MN471000 - Pressure Safety Manual, Chapter 8, "Servicing Pressure Vessels and Components"
19. (QUESTION 15b) MN471001 - ES&H Manual, Chapter 17, "Air Emissions"
20. (QUESTION 15b(3)) MN471001 - ES&H Manual, Chapter 17, "Air Emissions"
21. (QUESTION C1) Corporate Procedure: ESH100.2.IH.15, "Control Hazards Using Local Exhaust Ventilation and High Efficiency Particulate Air Filters"
22. (QUESTION C2) MN471001, ES&H Manual, Section 4L, "Personal Protective Equipment (PPE)," "General Requirements for Personal Protective Equipment (PPE)"
23. (QUESTION C2a(1)) MN471001, ES&H Manual, Section 4L, "Personal Protective Equipment (PPE)," "General Requirements for Personal Protective Equipment (PPE)"
24. (QUESTION C4) MN471001 - ES&H Manual, Section 10B, "National Environmental Policy Acy (NEPA), Cultural Resources, and Historic Properties"
25. (Required by general corporate business process) MN471001 - ES&H Manual, Section 4B, "Electrical Safety Practices"
26. (Required by general corporate business process) MN471001 - ES&H Manual, Section 4K, "Traffic Safety"
27. (Required by general corporate business process) MN471001, ES&H Manual, Section 21, "Technical Work Documents (TWDs)"

VII. Related Documents

NEPA Documents	Number	Project End Date
CINT Integration Laboratories (1501, 1504, 1523, 1525, and 1527)	SNA07-0202	

Other Documents	Number	Type	Published Date
Operating Procedure for Toxic/Pyrophoric/Inert Gas Cylinders Change-Out	OP1100.189	OP	01/17/2008
Standard Operating Procedure for Working with Hazardous and Particularly Hazardous Chemicals in Center 1100 Laboratories	SOP1100.001 Issue D	SOP	07/23/2008

Permits	Number	Type	End Date
CINT's Authority-to-Construct Permit No. 1725 Actual Date of Initial Start-up	No. 1725	Air	10/11/2004
City of Albuquerque - Wastewater Discharge Permit for CINT	2238A	Water	01/04/2007

VIII. Primary Hazard Screening Worksheets

Version of Questions:**I**

Operation Type:**Facility or Lab**

Interview Worksheet:

	Questions	Answers
1	**Radiation-Generating Devices (RGDs):** Is there a radiation-generating device (RGD)? (Answer this question "no" if the RGDs are registered in storage.)	No
2	**Radioactive Materials:** Is radioactive material present?	No
3	**Explosives and Ammunition:** Are any explosives or ammunition (including explosive waste) managed, handled, processed, used, or stored?	No
4	**Lasers:** Do the activities covered by this PHS involve Regulated Laser Activities?	No
5	**Chemicals:** ***(Review the Help text before answering this question.)*** Do the activities involve chemicals?	Yes
5a	Has the Industrial Hygiene Program performed an exposure assessment of all of the current activities involving chemicals covered by this PHS?	Yes
5a(1)	Did the results of the exposure assessment determine that workers are exposed to chemicals above an occupational exposure limit (regardless of respiratory protection)?	No
5b	Do any of the activities include? - Cleanup operations at hazardous waste sites (e.g., environmental restoration [ER] sites - Hazardous waste operations at treatment, storage, and disposal (TSD) facilities - Emergency response or post-emergency response	No
5c	Will activities have, use, synthesize, or liberate unbound engineered nanoscale particles (UNP)?	No
5d	***(Review the help text before answering this question.)*** Do the activities involve storage or utilization of simple asphyxiants?	Yes
5d(1)	In an accidental gas or cryogenic liquid asphyxiant release, could more than 560 cubic feet of asphyxiating gas be released into the work space?	No
5e	Are the hazardous chemicals, hazardous substances, or hazardous waste involved in these activities considered corrosive materials?	Yes
5f	Do these activities involve the use of hydrofluoric acid?	No
5g	Do chemicals used in the activities meet or exceed the Operational Permit Amounts for hazardous materials listed in the International Fire Code (IFC) and National Fire Protection Association (NFPA) Guidance? **(Please see IFC 105.6.20 Table 25-1 in the Help file for SNL Fire Protection's implementation requirements.)**	Yes
5h	Do the activities involve the storage, dispensing, or use of flammable or combustible liquids?	Yes

	Questions	Answers
5i	Do activities involve any of the following? - Flammable chemicals in quantities greater than 5 liters of liquid, 1 kg of solid, or 500 cubic feet of gas (at STP) in any single container or manifolded series of containers - Equipment connected to a house system for flammable gases - Reactive chemicals in quantities greater than 1 liter of liquid, 100 g of solid, or 500 cubic feet of gas in any single container or manifolded series of containers - Oxidizers, other than nitric acid, in quantities greater than 5 liters of liquid, 1 kg of solid, or 500 cubic feet of gas in any single container or process - Pyrophoric chemicals in total quantities greater than 500g - Metal powders in quantities greater than 1 kg	Yes
5i(1)	Is a flammable gas used for purposes OTHER THAN comfort heating or non-process hot water (e.g., restroom use)?	Yes
5i(1)a	Could more than 1000 cubic feet of flammable gas be released from a single container, manifolded series of containers, or house gas system?	No
5j	Do the activities include a process that involves highly hazardous chemicals at or above twenty-five percent of the Process Safety Management standard threshold quantities, or are there flammable liquids or gases involved in a process in a quantity of greater than 2,500 pounds?	No
5k	Do activities use or store toxic gases in quantities greater than the de minimus quantities listed in the Help file?	Yes
5k(1)	Do the activities use or store toxic gases in quantities equal to or greater than the threshold quantities listed in the Help file?	No
5l	***(Refer to help file to determine if quantities have been exceeded.)*** Do the activities use or store hazardous chemicals in quantities equal to or greater than the **Emergency Management screening threshold** quantities?	No
6	**Electrical:** Do workers conduct any of the following tasks? - Work on or near (within the limited approach boundary - 3.5 feet) exposed and energized (greater than or equal to 50 volts) electrical circuits or contact energized electrical circuit parts with tools or test probes? - Operate circuit breakers or disconnect switches operating at or above 50 Volts and 5 mA or more? - Perform non electrical work, but might contact exposed and energized electrical circuits - *operating at 50 volts or greater* - with equipment or materials, such as ladders, cranes, paint roller extensions, or forklifts? - Use Equipment that **operates at 50 Volts or more** and is **not listed** by an OSHA approved Nationally Recognized Testing Laboratory (e.g., UL) and operating at over 50 Volts, including extension cords or power strips?	Yes

Electrical Hazards	
Source Name	
(clear and enter a source name)	(no location data)

	Questions	Answers
6a	Do workers work on or near **(within the limited approach boundary - 3.5 feet)** exposed and **(greater than or equal to 50 volts)** energized electrical circuits or contact energized electrical circuit parts with tools or test probes?	Yes
6a(1)	Are **circuit parts** storing 10 Joules or more, associated with **Marx generators or pulsed power circuits**?	No
6a(2)	Are **circuit parts** associated with **facility** type **electrical distribution systems**?	No
6b	Do workers operate **circuit breakers** or **disconnect switches** operating at **50 Volts or more** and **5 mA or more**?	Yes
6c	Do workers **perform non electrical work,** but **might contact exposed and energized electrical circuits** - ***operating at 50 volts or more*** - with equipment or materials, such as ladders, cranes, paint-roller extensions, or forklifts?	No
6d	Do workers **use equipment** that operates at 50 Volts or more and is **not listed** by an OSHA-approved Nationally Recognized Testing Laboratory (e.g., UL), including extension cords and power strips?	Yes
6d(1)	Have all of the non-NRTL-approved electrical equipment or appliances been approved and documented using the Sandia non-NRTL-evaluation process?	No
7	**Mechanical:** Does the facility or activity involve any of the following hazards or activities? - machine shop equipment - portable power tools - powder-actuated tools - centrifuge operations - forklifts - motorized hand trucks - cranes/hoists, miscellaneous lifting devices, - industrial robots or industrial robotic systems - operate light or heavy earth-moving equipment - excavations - trenches - floor or wall penetrations - stored or kinetic mechanical energy that could cause an injury during normal working conditions	No
8	**Nonionizing Radiation:** At any time, do activities produce nonionizing radiation (NIR) (excluding lasers)?	Yes

Notes: All plasma etch and deposition equipment in the area use 100kHz and 13.56 MHz RF (up to 1300 watts) to ionize gas molecules within a reaction chamber. The reaction chambers and subsequent RF are well shielded to prevent uncontrolled emissions.

8a	Has the Industrial Hygiene Program performed an exposure assessment of the sources of nonionizing radiation covered by this PHS in their current configuration?	No
9	**Thermal:** Do thermal hazards or thermal stressors exist in the work area?	No
10	**Pressure:** Are workers involved in the design, installation, operation, or maintenance of a pressure system (including pressure, vacuum, cryogenic fluid applications)?	Yes
10a	Do personnel function as pressure system operators?	Yes
10b	Do personnel function as a pressure installers?	Yes
10c	Do personnel handle cryogenic fluids, or design, install, or operate cryogenic fluid-handling systems?	No
10d	Does an up-to-date data package or Pressure Safety Analysis Report, reflecting current personnel and system configuration, exist for all systems?	Yes

	Questions	Answers
10e	Do supplier-established pressure ratings exist for all systems and system components?	Yes
10f	Are pressure system (or component) reevaluations being performed according to the requirements of the Pressure Safety Manual? (A common example would be the replacement or retesting of pressure relief valves.)	Yes
11	**Noise:** At any time, do activities produce potentially high noise levels? - Noise that would require you to raise your voice to be heard by another person three feet away (greater than 85 decibels) (potential sources include: compressors, shredders, heavy machinery, saws, grinders, pumps, etc.) - High impulse/impact noise (potential sources include: explosions, gunshots, jackhammers, pressure releases, etc.) - Ultrasound noise (potential sources include: ultrasonic welders, ultrasonic cleaners, and turbo-pumps, fluid flow, etc.)	No
12	**Miscellaneous Hazards:** Does the facility or activity involve any of the following hazards or activities? - Ergonomic or musculosketal stressors - Construction-like activities - Work around asbestos - Ladders - Elevated surfaces (other than ladders) - Commercial underwater diving - animals and hazardous Plants - Aircraft - Airborne objects (other than aircraft) - Firearms - Use of human subjects - Use of Sealed Drums	No
13	**Outside of Manufacturer's Recommendations:** Does this work involve the use of **equipment, tools, or materials** outside of their design specifications or outside of the manufacturer's recommendations? (See Help Text for examples). Please enter each item into the hazard table.	No
14	**Non-Commercial Hazards:** Does this work involve the use of noncommercial equipment or apparatus (excluding robots, robotics systems, and equipment where the only hazard is a pressure system that has a pressure safety data package)? Please **enter each** noncommercial piece of equipment into the hazard table.	No
15	**Environmental Concerns:** Are there any potential **environmental concerns** with this activity that align with the SNL Environmental Management System (EMS) aspects, such as chemical use, fuel or oil storage, waste generation (except sanitary trash), construction activities, disturbance to habitat or protected species, or discharges to the air, ground surface, ground water, or the sewer systems?	Yes
15a	**Wastewater:** Are there any wastewater discharges in this activity?	No
15b	**Air:** Are there any air discharges or emissions at this activity?	Yes
15b(1)	**Ozone Depleting Substance (ODS):** Are there any **ODSs** at this activity?	No
15b(2)	Will this activity include the installation and or use of **combustion equipment**? Combustion equipment includes boilers and internal combustion engines, such as generators.	No
15b(3)	Will this activity include the use of chemicals that could be Clean Air Act Regulated?	Yes
15b(4)	Will this activity involve open-burn activities?	No

	Questions	Answers
15b(5)	Will this activity involve **soil disturbance, building demolition,** or **construction** that **disturbs soil,**, including access roads and staging areas?	No
15b(6)	**Radionuclide NESHAP:** Are there any **radionuclide air discharges** or use of radionuclides in gaseous form or at elevated temperatures at this activity?	No
15c	**Radioactive Waste:** Will this activity generate any radioactive waste, or will Members of the Workforce be required to handle radioactive waste?	No
15d	**Hazardous Waste:** Will this activity generate any hazardous waste, or will Members of the Workforce be required to handle hazardous waste?	No
15e	**Mixed Waste:** Will this activity generate any **mixed waste**, or will Members of the Workforce be required to manage mixed waste?	No
15f	**Infectious / Biohazardous Waste:** Will this activity generate any infectious or biohazardous waste, or will Members of the Workforce be required to handle infectious or biohazardous waste?	No
15g	**Radioactive Contamination:** Will this activity be conducted in an area for which a reasonable potential exists for introducing **radioactive contamination** or causing activation of material that may become waste?	No
15h	**Material or Waste of Unknown Origin:** Will this activity require handling material or waste of unknown origin?	No
15i	**Fuels and Oil Storage:** Does this activity use a fuel or oil storage container capable of containing 55 gallons or more?	No
15j	**Discharges to Ground Surface:** Does this activity have a potential for any **discharges to the ground surface**?	No
15k	**Improvements/modifications to structure/building exteriors and landscaping:** Will this project involve activities that require modifications to the exteriors of structures and buildings or modification to existing landscape, including removal of vegetation?	No
15l	**Disturbance to habitat or protected species**: Will this project involve activities that will disturb habitat or protected species, including wildlife management and outdoor projects or testing activities?	No
16	**Packaging and Transportation of Hazardous Materials:** Will any activities covered by this PHS involve the packaging and transportation of hazardous material (including explosives or radioactive material)?	No
17	**Fire Protection Concerns:** Will the activity include any of the following? - Members of the Workforce modifying in any way any fire suppression or life safety system (fire rated walls, fire doors, fire sprinklers, fire alarm devices, fire extinguishers, or means of egress)? - Members of the Workforce performing hot work in association with this facility or project activity?	No
18	**Biological Materials:** *(see Help text before answering this question.)* Do activities involve the use of or potential exposure to biological materials?	No
19	**Confined Spaces:** Are confined spaces present in the work area?	No

	Questions	Answers
20	**Beryllium:** Do operations include any activities that? *(Review the Help text before answering this question)* - Use or handle beryllium, beryllium-containing alloys or beryllium oxides? - Create or work with **beryllium ceramics**? - Handle waste potentially-contaminated with beryllium or waste containing beryllium? - Perform **decontamination** of beryllium contamination? - Entail work in a beryllium contaminated building or area? - Apply abrasive or destructive methods to metal objects, articles, weapon components or bar stock, potentially containing beryllium? - Use non sparking tools containing beryllium?	No
21	**Other Hazards:** Are there any: - Hazards that have **not been adequately addressed** in other questions. (e.g., polar bears, foreign travel, specific chemical hazards, natural hazards [e.g., wind, excessive water, radon, or overhead trees]), **or** - Hazards of **unknown magnitude** (e.g., emergency response, hazards encountered by roving personnel) **Enter all of these hazards in the User- Specified Hazards table.** Enter "**Low**" as the **Hazard Classification** for hazards of unknown magnitude, unless the Safety Basis Department has determined otherwise.	No

Controls Worksheet:

	Questions	Answers
C1	**Local Exhaust Ventilation:** Do the activities covered by this PHS use local exhaust ventilation (LEV) (e.g., laboratory hoods, glove boxes, downdraft tables, "elephant trunks," canopy hoods, paint booths, slot ventilation, portable welding ventilation, etc.)?	Yes
C2	**Personal Protective Equipment:** Are hazards (e.g., chemicals radiological, electrical, mechanical, thermal, flying particles and/or falling or rolling objects) encountered that are capable of causing injury or impairment in the function of any part of the body through absorption, inhalation, or physical contact?	Yes
C2a	Has a workplace hazard assessment been performed for the activities covered by this PHS?	Yes
C2a(1)	Did the workplace hazard assessment determine that personal protective equipment will be required?	Yes
C2a(1)a	Has the workplace hazard assessment determined respiratory protection is required?	No
C2a(2)	Does the workplace hazard assessment allow voluntary use of respiratory protection?	No
C3	**Control of Hazardous Energy (LOTO):** Do you have **any equipment** in your operations that requires any of the following activities? - Construction - Installation - Setup - Adjustment - Inspection - Modification - Maintenance - Service - Lubrication - Cleaning - Unjamming - Making adjustments or tool changes	No
C4	**NEPA Compliance:** Has this project or activity been reviewed for National Environmental Policy Act (NEPA) compliance?	Yes
C4a	Are all relevant NEPA documents listed in the Documents section of this PHS?	Yes

IX. Hazard Analysis (HA) Section

Hazard Analysis

Source Name or Question: **Question 5k(1)**
Source Reason: **Toxic gasses**
Hazardous Condition: **Inhalation / Potential for environmental release**

PHS Identified 'Low' Hazard.

Author's Comment: **The gases of concern are Ammonia (1 lb), Chlorine (1 lb), Boron Trichloride (1 lb) and Silane (8 lbs). All are contained within gas cabinets which are designed to shut down upon detection of any leaks.**

Cause: System/Component/Equipment Failure

The valve of the cylinder fails causing a leak.

Consequence: Major Illness/Injury

Personnel are exposed to gases.

Mitigation: Active Engineering Control-Other

The system is designed to shut off the gas if it were detected within the gas cabinet.

Mitigation: Procedural/TWD (SOP/OP/RWP)-Other

Doc Id: OP1100.189 **Title: Operating Procedure for Toxic/Pyrophoric/Inert Gas Cylinders Change-Out**

Personnel have read and signed off on the operating procedure.

Mitigation: Warning Device-Audible Alarm (horn/bell/whistle)

A high level alarm will activate upon the detection of a leak at 3 times the Threshold Value Limit. A high level alarm also activates the fire alarm, notifying personnel to evacuate the building.

Mitigation: Training-Other

Personnel have completed site specific training for integration lab activities and are aware of the hazards and what to do in case of an emergency.

Author Assessment: Applied Mitigation and Prevention are sufficient.

The design of the cabinet to shut off the gas upon a leak detection, the procedure, alarm system and training are adequate controls for this hazard.

Source Name or Question: **Question 8a**
Source Reason: **Unevaluated nonionizing radiation**
Hazardous Condition: **Potential exposure to nonionizing radiation.**

PHS Identified 'Low' Hazard.

Author's Comment: **Magnetic fields of the PECVD systems**

Cause: System/Component/Equipment Failure

The design of containing the PECVD systems to contain the non-ionizing radiation fails.

Consequence: Minor Illness/Injury

Personnel are exposed to non-ionizing radiation.

Mitigation: Passive Engineering Control-Radiation Barrier (lead/concrete type shielding)

The system is designed to contain the non-ionizing radiation and to mitigate exposure to personnel.

Mitigation: Procedural/TWD (SOP/OP/RWP)-Other

Personnel follow procedures on the use of the equipment and it also addresses the hazards and mitigations associated with the equipment.

Mitigation: Training-Other

Personnel complete ILUA (Integrated Lab Unescorted Access) training.

Mitigation: Training-Other

Course Id: LAB103 **Title:** SITE-SPECIFIC LABORATORY SAFETY TRAINING

Site specific training on equipment is completed by personnel.

Author Assessment: Applied Mitigation and Prevention are sufficient.

Engineering controls, procedures and training are deemed adequate.

Source Name or Question: **Question 5i(1)a**
Source Reason: **Use or storage of flammable gasses**
Hazardous Condition: **Fire or explosion**

PHS Identified 'Low' Hazard.

Author's Comment:

Cause: System/Component/Equipment Failure

Regulator diaphram failure or other component faliure that results in a leak.

Consequence: Minor Property Damage

Fire inside of gas cabinet.

Mitigation: Active Engineering Control-Other

Restrictive flow orifice slows the release of gas.

Mitigation: Passive Engineering Control-Fire Barrier (fire wall/door/coating)

Gas enclosed in specialty designed cabinet to prevent the spread of fire.

Mitigation: Active Engineering Control-Fire Suppression System

Sprinkler integrated into the gas cabinet to maintain control of cylinder temperature.

Mitigation: Active Engineering Control-Other

Gas leak detection, shuts off gas supply at the cylinder in the event of a leak. A fusible link also breaks pneumatic air pressure to the cylinder's air operated valve when melted (~100C).

Mitigation: Warning Device-Audible Alarm (horn/bell/whistle)

Gas leak triggers both a local and global alarm.

Author Assessment: Applied Mitigation and Prevention are sufficient.

The gas cabinet used to store and deliver the pyrophoric gas is specifically designed for this particular hazard (Silane).

Source Name or Question: **Question 6d(1)**
Source Reason: **Electrical equipment operating at 50V or greater that is not NRTL-approved**
Hazardous Condition: **Electrocution/Arcs/Fires**

PHS Identified 'Low' Hazard.

Author's Comment:

Cause: System/Component/Equipment Failure

Short circuit to neutral or ground.

Consequence: Minor Mission Disruption/Delay

Loss of power to tool and subsequent shut down.

Mitigation: Active Engineering Control-Other

Properly sized circuit breaker or fuse to open circuit in the event of an overcurrent situation.

Mitigation: Passive Engineering Control-Other

Components and wiring appropriately sized to operate well above the trip point of the overcurrent protection devices.

Author Assessment: Applied Mitigation and Prevention are sufficient.

Preventions/mitigations follow typical NEC guidelines and industry standards.

Consequence: Death [Worker]

Electrocution if the worker should provide a low impedance path through the central nervous system or heart to ground.

Mitigation: Active Engineering Control-Other

Incorporation of UL approved ground fault interrupt circuit protection to outlets within 6' of water soures.

Mitigation: Passive Engineering Control-Access Prevention Barrier (locked door/gate)

Panels with exposed terminals are not easily accessible and require a tool for removal.

Mitigation: Procedural (Monitoring etc.)-Other

Ground fault interupters are tested for proper operation on a routine basis.

Mitigation: Active Engineering Control-Other

Emergency power off circuitry, allows the removal of power from the entire system when pressed. Requires operator intervention to restart.

Author Assessment: Applied Mitigation and Prevention are sufficient.

Preventions and mitigations described above follow guidlines established by the NEC and are considered to be normal measures to protect against accidental electrocution.

Consequence: Minor Property Damage

Electrical fire in an enclosure.

Mitigation: Passive Engineering Control-Fire Barrier (fire wall/door/coating)

Electrical components and power distribution circuits are in metallic enclosures.

Author Assessment: Applied Mitigation and Prevention are sufficient.

Components and materials of construction follow industry standards that prevent the spread of fire.

Note: 12 hazard analysis(es) were not reported, because no (optional) hazard analysis was performed for them.

X. Supplemental Information

PHS Input

Notes from Interview Questions

(Q 8) - All plasma etch and deposition equipment in the area use 100kHz and 13.56 MHz RF (up to 1300 watts) to ionize gas molecules within a reaction chamber. The reaction chambers and subsequent RF are well shielded to prevent uncontrolled emissions.

Notes from Controls Questions

User Entered Hazard Tables

Electrical Hazards	
Source Name	
(clear and enter a source name)	(no location data)

PHS Output - Results and Conclusions

Major Safety Concerns

The hazard classification is: **Low**

The required documentation is: **PHS with integral HA**

The hazard classification is: Low since this Facility or Lab involves:
(QUESTION 5i(1)a) Potential fire and explosion
(QUESTION 5k(1)) Potential exposure to toxic gasses in the event of a release
(QUESTION 6d(1)) unknown hazard potential since items have not gone through the standards, testing rigor, and hazard analysis associated with an NRTL-evaluation
(QUESTION 8a) Potential exposure to nonionizing radiation.
****

Other Safety Concerns (potential hazard sources) for this Facility or Lab

(Required by general corporate business process) traffic related hazards for injury
(Required by general corporate business process) common electrical hazards
(QUESTION 5) Potential personnel exposure to chemicals & fire protection regulatory requirements
(QUESTION 5e) Corrosive chemical; Potential exposure to skin and eyes.
(QUESTION 5h) fire/explosion hazard
(QUESTION 5i) hazards from fires, reactions, and explosions
(QUESTION 6a) potential electrical shock or arc
(QUESTION 6b) potential electrical arc from operating circuit breakers or disconnect switches
(QUESTION 10) Injury or damage
(QUESTION 15) potential for regulatory action
(QUESTION 15b) potential to emit regulated contaminants
(QUESTION 15b(3)) potential to emit regulated contaminants
****

Required Training

[Note: This training is a regulatory requirement for one or more people involved in operations associated with identified hazards. Each class may not be required by all people working in the area.] Please note that some training classes are only provided occasionally. Please be sure to allow adequate lead-time for personnel to schedule and complete training.]

NONE

****

Results Based On Answers

The results in this PHS were based on the following answers to interview questions:
Q 0 answered: Y; Q 5 answered: Y; Q 5e answered: Y; Q 5g answered: Y; Q 5h answered: Y; Q 5i answered: Y; Q 5i(1)a answered: N; Q 5k(1) answered: N; Q 6a answered: Y; Q 6a(2) answered: N; Q 6b answered: Y; Q 6d(1) answered: N; Q 8 answered: Y; Q 8a answered: N; Q 10 answered: Y; Q 10a answered: Y; Q 10b answered: Y; Q 10d answered: Y; Q 10e answered: Y; Q 10f answered: Y; Q 15 answered: Y; Q 15b answered: Y; Q 15b(3) answered: Y;

****

Interquestion Dependency Concerns for this Facility or Lab document:

[Note: Interquestion dependency is an automated check for the potential of a missed hazard (e.g. the PHS identifies radioactive waste but does not identify radioactive material). Please review these inconsistencies to ensure the PHS interview questions are answered correctly. There may be valid reasons for these anomalies.]

(QUESTION 5) If there are chemicals (5), there may also be hazardous waste (15d), but none is indicated.

XI. EOC Concerns

Chemical; Energized Electrical; Environmental Concerns; Non-ionizing Radiation; Pressure